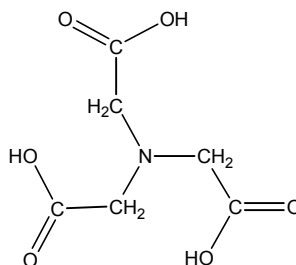


NITRILOTRIACETIC ACID

CAS No. 139-13-9

First Listed in the *Third Annual Report on Carcinogens*



CARCINOGENICITY

Nitrilotriacetic acid is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (NCI 6, 1977; Goyer et al., 1981). When administered in the diet, nitrilotriacetic acid induced transitional cell carcinomas of the ureter in rats of both sexes, kidney in male rats, and urinary bladder in female rats. When administered in the diet, the compound induced kidney tumors in male mice.

There are no data available to evaluate the carcinogenicity of nitrilotriacetic acid in humans.

PROPERTIES

Nitrilotriacetic acid is a combustible, white crystalline powder that is insoluble in water and most organic solvents. The compound forms mono-, di-, and tribasic salts that are soluble in water. When heated to decomposition, these compounds emit toxic fumes of nitrogen oxides (NO_x) and sodium oxide (Na₂O). The commercial products are 99.5% pure and may contain traces of metals and formaldehyde. This compound is incompatible with strong oxidizers, aluminum, copper, copper alloy, nickel and strong bases (Radian, 1991).

USE

Nitrilotriacetic acid is used primarily as a chelating agent and as a binder in synthetic detergents. The compound sequesters magnesium and calcium ions present in hard water which would normally inhibit the activity of detergent surfactants. In the late 1960s, nitrilotriacetic acid generally replaced phosphates in commercial detergents (NCI 6, 1977). According to EPA, this use was voluntarily suspended in the United States in December 1970; however, resumed use arose in 1980. Nitrilotriacetic acid is also used as a chelator in water treatment, textile manufacture, and analytical chemistry. It is used as an eluting agent in purification of rare-earth elements. It is also used as a boiler feedwater additive and in metal plating, metal cleaning and pulp and paper processing (HSDB, 1992). To a lesser extent, the compound is used in leather tanning, photographic development, synthetic rubber production, the manufacture of pharmaceuticals, herbicide formulations and micronutrient solutions in agriculture, and the separation of rare-earth elements (NCI 6, 1977; Sax, 1987).

PRODUCTION

The USITC identified four manufacturers in 1985-1988 and a single manufacturer from 1980 to 1984, producing undisclosed amounts of nitrilotriacetic acid (USITC, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989). EPA reported that domestic production of nitrilotriacetic acid in 1982 was about 65 million lb by two companies. In 1979, EPA estimated that 70 million to 75 million lb of nitrilotriacetic acid were produced in the United States, and 60 million to 65 million lb were exported. The 1979 TSCA Inventory reported that one company produced an unspecified volume of nitrilotriacetic acid and two companies imported 55,000 lb in 1977. The CBI Aggregate was less than 1 million lb. The Inventory also reported that three companies produced 75 million lb of the trisodium salt of nitrilotriacetic acid and one company imported 500 lb in 1977. The CBI Aggregate was between 100 million and 1 billion lb (TSCA, 1979). In 1970, the year before the use of nitrilotriacetic acid in detergents was suspended, the United States produced 150 million lb, of which 86%-92% was used in detergents (NCI 6, 1977).

EXPOSURE

The primary routes of potential human exposure to nitrilotriacetic acid are inhalation, ingestion, and dermal contact. Potential occupational exposure occurs during the manufacture of the compound or its salts, during water treatment, and during other production procedures in which the compound is used. The National Occupational Exposure Survey (1981-1983) indicated that estimated 3,572 workers, including 1,890 women, potentially were exposed to nitrilotriacetic acid (NIOSH, 1984). The National Occupational Hazard Survey, conducted by NIOSH from 1972 to 1974, estimated that 14,600 workers were possibly exposed to nitrilotriacetic acid, trisodium salt in the workplace in 1970 (NIOSH, 1976). Worker exposure in detergent formulating factories has been estimated to be < 4.8 µg/kg for adult males and < 3.6 µg/kg for adult females. According to industry, the synthesis and packaging of nitrilotriacetic acid is automated. This would indicate that occupational exposure during production is minimal. The maximum air concentration of nitrilotriacetic acid in the hopper car loading area of one production facility was measured to be 8.2 mg/8-hr workday (EPA OTS, 1979).

In the spring of 1980, EPA released a statement indicating that it would not take regulatory action against the use of nitrilotriacetic acid in laundry detergents. Adults potentially will be exposed to between 0.009 and 966 µg nitrilotriacetic acid/day (EPA OTS, 1979). Nitrilotriacetic acid is potentially 70% biodegradable (Sax, 1987). It has been determined, however, that detergent effluents may combine with industrial discharges or seepage from septic tanks to form toxic heavy metal complexes, some of which are resistant to biodegradation. There is also a possibility, under certain conditions, that nitrilotriacetic acid may react with nitrites to form nitrosamines. The concentration of nitrilotriacetic acid in wastewater in Canada, where the compound is widely used in detergents, has been reported to be 15-30 mg/L. The compound is presently used in detergents in two U.S. states where phosphates are banned. If all phosphate in U.S. detergents was replaced by nitrilotriacetic acid, it is estimated that wastewater concentrations would approach 20 mg/L, receiving waters would contain no more than 25 µg/L, and that little or none would be detectable in drinking water (Artman, 1973; Thayer & Kensler, 1973). EPA estimated that concentrations of nitrilotriacetic acid in drinking water before the termination of its use in detergents was between 0.2 and 24.5 µg/L. EPA has cautioned against the use of the compound in shampoos, foods, hand dishwashing detergents, and other products which may provide a risk of oral or dermal exposure. Trace residues possibly may remain in processed foods. The Toxic Chemical Release Inventory (EPA) listed 16 industrial facilities that produced, processed, or otherwise used nitrilotriacetic acid in 1988 (TRI, 1990). In compliance

with the Community Right-to-Know Program, the facilities reported releases of nitrilotriacetic acid to the environment which were estimated to total 17,000 lb.

REGULATIONS

EPA regulates nitrilotriacetic acid under the Superfund Amendments and Reauthorization Act (SARA), subjecting it to reporting requirements. Under the Toxic Substances Control Act (TSCA), EPA included some caveats as recommendations to manufacturers and processors of nitrilotriacetic acid, even though EPA determined that exposure of adults to the compound was low (1 µg/kg per day). FDA regulates trisodium nitrilotriacetic acid as a secondary direct food additive, that is, as a substance added to food during preparation or handling, and subsequently removed before the food is ready for consumption. FDA limits trisodium nitrilotriacetic acid added to boiler feed-water to 5 ppm, and now is reviewing the carcinogenicity data on nitrilotriacetic acid for possible future regulatory actions. OSHA regulates nitrilotriacetic acid under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table B-89.